TABLE 2 MOLLUSK HABITATS (Continued):

SLUGS	SUITABLE HABITAT	KEY FEATURES
Deroceras hesperium	Forested areas west of the crest of the Cascade Range, usually below 610 m (2000 ft).	Variety of low shrubs*, litter*, debris, & rocks*.
Hemphillia burringtoni	Mesic to moist conifer forests.	Conifer logs* and/or heavy ground cover of low vegetation, litter and debris.
Hemphillia glandulosa	Mesic to moist conifer forests.	Conifer logs* and/or heavy ground cover of low vegetation, litter and debris.
Hemphillia malonei	Moist conifer plant associations.	Bark under hardwood trees* or logs*.
Prophysaon coeruleum	Conifer forests.	Conifer and hardwood logs*, ground litter & mosses.
Prophysaon dubium	Conifer forests, with hardwood component.	Hardwood logs* & leaf litter among shrubs*.

II. Survey Procedures

To implement this protocol, two visits to a project area are required, one of which should be during the fall rainy season. For each visit, a total of one hour of survey for every ten acres of affected habitat must be completed using a combination of two sampling methods. Once the extent of suitable habitat in a project area is identified, an opportunistic search of key habitat features along a survey route distributes a general search effort over the entire area. More intensive searching of small, well defined "sample areas" provides an additional survey method that increases the probability of finding target species in concentrations of the best habitat for those species.

Special habitats such as rock talus require different survey methods that are described in a separate section, II.B.2.a. In addition, several species of C-3 mollusks are unique enough to require individual survey methods, also described in section II.B.2.b.

Permits are required in Washington State for collection of specimens (see Appendix D).

II.A. Plan the Surveys

II.A.1. Identify the **Survey Area**, and delineate it on a map and/or aerial photographs. These maps will serve to document and describe the areas surveyed. A survey area is the area containing suitable habitat that will be impacted directly or indirectly by the proposed activity. It is the area to be effectively covered by the survey. It may be all or a portion of a project area, sale unit or other impacted area as well as the adjacent suitable habitat considered to be affected by the proposed

action. In situations where more than one type of suitable habitat is identified within a project area, the boundaries of each should be delineated and surveyed separately. For example, the project may include a talus deposit or rocky outcrop within a matrix of general forest habitat. Range descriptions also indicate that species using talus habitats are suspected in the area in addition to species using the general forest habitat. In this case, independent surveys, using protocol methods for each "survey area", are required.

Give each survey area and sample area a name (i.e., a pertinent landmark, geographic feature, or project name) and a number to distinguish between units and sample areas, and to correlate with field forms and notes.

The following methods pertain to suitable forest habitat types with key habitat features found scattered in them. Certain types of habitat including rock outcrops, caves and talus, as well as certain species require specific search methods that differ somewhat from the following discussion of survey methods. Please refer to Section II.B.2. for a discussion of these methods.

II.A.2. Identify tentative **survey routes** through previously defined "survey areas" using the maps and photos. Locate the survey routes to effectively cover the survey area and pass through any areas within it that have a concentration of the key habitat features described for the species of interest. The survey route should meander through much of the whole survey area. Distance from existing roads or edges does not appear to be important. These preliminary routes may be modified in the field as better survey routes become apparent, but the final map should reflect these changes. This map should be retained in the case file.

During the surveys, opportunistic **point searches** will be made of key habitat features along the survey routes. Routes should be laid out in a way that a searcher can examine as many of these features as possible while staying within the general route.

II.A.3. Identify and mark **sample areas** in the field along or near the "survey route", approximately **5 m. (16.5 ft) radius or 80 sq.m. (270 sq.ft.) in size**, which encompass areas with a number of key habitat features for the target species. In some cases, the best sample areas may be around only one feature, such as a large tree or down log. These areas do not need to be circular, but should be defined areas of the required size encompassing concentrations of the key habitat features. These are areas in which an intensive time-constrained search will be conducted. For the purpose of establishing sample areas, the asterisked key features in Table 2. should be used if possible. Sample areas do not need to be evenly spaced within the survey area, but they should be distributed throughout the best suitable habitat within it.

A minimum of two "sample areas" should be identified for every ten acres of suitable habitat in the "survey area". For "survey areas" less than ten acres in size, this minimum number of two "sample areas" is still required unless the extent of the suitable habitat is less than the extent of the "sample areas", in which case the entire "survey area" should be searched.

For the purpose of determining the number of "sample areas" to survey, ***only acres of suitable habitat*** will be measured. However, it should be recognized that a striking change in habitat would be needed to separate suitable and nonsuitable habitat for most species, (ie. nonforest, clear-cut or grassy meadow vs. general forest).

II-B. Survey Methods

II-B-1. General Methods for Forest Species

These sampling methods are pertinent to all forest species. For special habitats such as rock talus or for a few species that require special survey techniques, see also section 2, "Additional Survey Methods". While one person can do these surveys, 2 or 3 surveyors working together can cover more area and will find more mollusk species than a single surveyor will. However, the time required for survey will not decrease if multiple surveyors are used except in cases where all target species are found in a given sample area.

II.B.1.a Walk the survey route, looking for key features and searching in likely places for snails and slugs. Opportunisitcally search around key habitat features within approximately 10 meters (33ft.) of the route. These short **"point searches"** are done by rolling over small logs, looking under bits of bark, rocks, vegetation and debris, picking through hardwood leaf litter and searching the needle and leaf litter at the bases of logs and shrubs. In other words, a surveyor checks a representative sample of points where snails and slugs might be expected to be found. These "point searches" may consist of continuous sampling or more scattered, localized sampling of several key habitat features along the route. No single point should be searched for longer than 5 minutes.

At least **20 minutes for every 10 acres of "survey area"** should be spent checking key habitat features in "point searches" **outside** of "sample areas" along the route . This type of searching has been found to increase opportunities to discover species of mollusks in less than ideal situations and to locate species that were not expected in the search area. It also serves to distribute the search effort over the survey area and to help delineate the extent of known sites.

II.B.1.b Survey of a **"sample area"** is similar to that done along the route in point searches, but it is more intensely concentrated and confined to a specific area. Each designated **"sample area" should be searched for a total of 20 minutes or less if all target species have been located.** Search time should be distributed evenly in order to cover the entire sample area. During the search, 1) examine all or most large debris within the sample area, especially the moss and accumulated litter along the sides of logs; 2) search through and under several shrubs and other plants ; 3) sort through leaf and needle litter down to bare soil in several patches of one-half square meter (2.5 sq.ft.) or less; and 4) examine smooth lower trunks, leaves and branches of hardwood trees and shrubs within easy reach. Efforts should be made to recognize and avoid disturbance to Survey and Manage moss species that might be encountered during this process. If such a moss is located, the site should be marked and referred for positive identification by field botanists. This is not to be a destructive sample, but the plot will be disturbed significantly. Therefore, surveyors should

endeavor to replace habitat components to their original positions immediately and to replace litter back over areas from which it was removed. Time spent searching should not include time spent recording data or other activities. This type of search emphasizes discovery of hard to find specimens by doing a thorough search of the best habitat.

II.B.1.c. Flag or mark each site at which a C-3 species is found for future reference. If unknown specimens or shells are collected, mark those sites as well, in case a later identification reveals a C-3 site. Identify specimens observed and record survey information on field forms, (see Appendix F, Species Identification and Key and Appendix E, Field Form). The upper portion of the sample form includes information about the general survey area. **If no target species are located during a visit, to a survey area, only one field form is necessary per visit.** The form should contain the required information describing the location of the survey area, date, surveyor and time spent searching.

The lower portion of this field form is used for information about individual sites where target species are located. These sites may be a point along the survey route or a sample area. Identify and record target mollusk species observed, **using one field form for each new site** (several species may be recorded at a single site using one form). If unable to identify a species in the field, record the location and habitat information where an unknown specimen was found and collect representative specimens, using empty shells when feasible, for later identification. Label containers clearly to correspond to the site description. Keep all live specimens cool and moist and include local vegetation in the containers with the specimens.

Record all target species encountered at a site at least once on the field form and the time of day at which each was first found, to document times between new species for a check for adequate surveys. If a species is not known, record it to the nearest known taxon (e.g., *Punctum* sp.1; or, Snail sp.1) and note the time it was first encountered (see Appendix E for more details on filling out field forms).

Some elements on the lower portion of the form, such as **species name and location are required.** Space is also provided for recording optional habitat information gathered at known sites. Although not required, we suggest that you record this information when locating C-3 species in order to further refine the habitat associations known for these species.

II-B-2. Additional Survey Methods

II.B.2.a. Survey Methods in rocky areas, talus and cave features.

Several species of C-3 mollusks listed in Table 2 are known to be associated with rocky substrates. When conducting a survey for any target species with key features listed as talus, rock outcrops or caves use the following survey methods. (Note: Protocol surveys for the Del Norte salamander may be required in areas that also require mollusk surveys. Differences exist between the standards set in the two protocols, however, and care should be taken to ensure that all requirements for both protocols are met if attempts are made to consolidate surveys. At the least, surveyors should be

familiar with all C-3 species, mollusk and amphibian, potentailly found in talus habitats in their local areas so that incidental observations of them can be documented.)

i. General Information

Areas with rock exposures are important mollusk habitats. They can offer refugia from predators, temperature extremes, and moisture extremes. Frequently, they also have relatively dependable food and water resources in areas where the general conditions are relatively hostile to mollusks.

ii. Caves (including sinkholes and fissures):

Caves on federal lands are protected by the Federal Cave Resources Protection Act of 1988. Rare and endemic plant and animal species are commonly associated with these fragile habitats. Appropriate authorization shall be obtained before performing a survey within or near a cave. Do not survey in a cave during cold weather when hibernating bat species may be disturbed.

The Occupational Safety and Health Administration confined space rules, as well as safety regulations of the surface management agency, may also apply.

No living specimens should be collected from caves without the appropriate permits that define the specific research goals. Surveying for species presence shall generally consist of looking for empty shells near the cave, sinkhole, or fissure on the surface, and under rocks or debris. Searching within the feature will be similarly limited to looking on the walls and floor and under any loose rocks or debris. All materials moved should be returned to their original position.

If it is absolutely necessary to collect or verify the presence of living specimens, then the survey should be performed at night with headlamps during wet weather.

iii. Talus and Rocky Area Suitable Habitat:

Rocky areas and talus deposits have been found to be important mollusk habitats regardless of climatic regime or associated plant community. Certain species are restricted to these areas, however, all mollusks will use them. Rocky areas are especially significant in areas with little plant cover (generally arid to semi-arid areas). In open or arid to semi-arid localities, the bottom 1/3 of a talus slope is the best area to search as moisture and temperature conditions tend to be more stable within this area. The talus deposit itself is less subject to movement in the lower 1/3 unless the substrate is unstable.

Where talus, cliff face, isolated rock outcrop, or other rocky area is near a flood plain, in a forest, or is shaded for most of the year, the whole area should be considered suitable habitat. Note that very small rocky areas can be as important as a large area. Foraging areas can be a vegetated area within a talus or rocky area or along the edge. An unvegetated center of a large unshaded talus deposit would probably not be good habitat. Mollusk species will travel out of their refuge to forage but

rarely travel more than 10 m.(33ft) from their secure habitat. Therefore, deposits separated by more than 20 m.(66 ft) of nonsuitable habitat should be considered individual survey areas.

Another important factor to consider is the size of the rocks in the deposit. Mollusks will not generally be in areas where they have to travel more than a few meters down to the soil surface, so areas composed of deep beds of large rocks are not the best areas to search. However, talus caves and areas around the drip line of large stable rocks are logical sites to search. Talus consisting of small cobble to gravel size materials (i.e.,<7 cm (2 in) diameter) is considered suitable habitat for many species of mollusks. Smaller species such as *Trilobopsis* spp. or *Vertigo* spp. may be found in gravel deposits ranging from 0.5 to 8 cm in diameter, but if the deposit is covered with silt or sod, crawl space is restricted or lost and the deposit is unsuitable habitat.

The composition and texture of talus deposits may have a strong influence on mollusk distribution. For example, cinder, scoria, and other sharp surface talus deposits are not normally suitable habitat.

Vegetation that is most commonly associated with talus where mollusks occur include nettle (*Urtica* spp.), horse tail (*Equisetum* spp.), and small shrubs and brush such as poison oak (*Rhus diversiloba* = *Toxicodendron horribilis*), hackberry (*Celtis reticulata*), ninebark (*Physocarpus*), and California laurel (*Umbellularia californica*). In areas with permanent seeps or springs, watercress (*Rorippa*), poison hemlock (*Cicuta*), Oregon myrtle (*Umbellularia californica*), speedwell (*Veronica*), and monkey flower (*Mimulus*) often have associated snail or slug colonies.

iv. Rocky Area Survey Procedure

Concentrate the survey in the areas or conditions described above, delineating the survey area as described in Section II.A.1 of the general survey methods. A well distributed search of most rocky areas can be done by walking through the area and searching suitable sites as they are encountered. No designated sample areas are required unless the survey area is larger than one acre. Carefully search between, on the sides of and under rocks, and in litter beneath vegetation. Remove the rocks if possible, down to the soil or bedrock substrate. The rocks should be replaced immediately to limit potentially adverse impacts to the habitat. Concentrate on moving those rocks that are easily and safely handled. Use a hand rake to loosen gravel substrates and to search between small cobbles.

The timing of surveys in rocky areas is discussed in section II.C.1.a. below.

II.B.2.b. Species Requiring Special Survey Techniques

Although the basic methods described for general forest species should be applicable, four snail species are unique enough to require additional special techniques for an adequate survey. These species are discussed below.

the branches of shrubs. *Vertigo* have elongate shells and will appear as a small bud. Also search leaf litter and bits of bark on the ground. Pick up a small handful of dead leaves, being sure to include mostly damp ones from underneath. Turn the leaves over one at a time and examine both sides for snails. Use a 10-15x hand lens to examine any small object that might be a snail. Also see the "alternate method" under *Pristiloma*, above.

Collect shells and or living specimens (of adults only) to be examined in the laboratory. Living specimens may be allowed to die, and dry up, since shells are sufficient for identifying the Hoko Vertigo. In order to ensure that a good specimen is available with all the key characteristics, at least 5 to 10 should be provided to verify the species, which will likely require collection of living snails to find a sufficient quantity. Identification of this species is difficult and may require expert assistance.

II-C. Timing of Surveys (Season and Frequency for Sampling)

Survey timing is discussed in 4 ways: (1) time of year or season to survey (which is the most important consideration); (2) time of day (which is generally not critical, but understanding daily activity patterns of mollusks is helpful in finding them); (3) the number of visits to a survey area (which is correlated with appropriate environmental conditions); and (4) duration (time spent surveying each survey area).

II.C.1. Time of Year

The survey period will vary from year to year with seasonal weather and locality. Favorable weather conditions are a prerequisite for adequate surveys. Surveys can usually begin in mid-September to early-October but variations in seasonal weather from year to year may justify an earlier or later survey season. They can normally begin 1) after autumn rains have soaked the ground (i.e., after three days of moderate to heavy rains, 2) when the forest floor litter is wet through to the soil in openings between trees), or 3) after morning dew or frost is present if surveying in areas (or years) in which autumn rains may not occur before the ground freezes. At least one survey visit should be done well into the autumn rainy season or after regular night frosts occur. The best indicator of optimal conditions is when several species of snails and slugs (and amphibians) are easily found and some are out on the ground, litter, logs, or vegetation. Surveys may continue into the late fall or early winter until the air temperature remains below 5°C (40° F) for more than three days, until the ground remains frozen or until snow prevents a reasonable search. They may resume in the spring after the snow has melted, the ground is thoroughly thawed and the day-time air temperature remains above 5°C (40°F). Surveys may continue into early summer until the top half-inch of soil is dry or temperatures remain above 27°C (80°F) during the day. In warm climates, there may be only a single wet season, in which case surveys may be conducted over a period of several months.

Several species of slugs are known to be most easily found and identified in the fall when they are adults. Surveys for slugs during the early spring season are not recommended, however specimens become larger and more visible during the later portions of this season. Snails within dryland

habitats of northern California are best found in the spring when they are dispersing and foraging which makes them more visible; during the fall they may be breeding in secluded recesses. In rocky habitats, late fall and early spring are the best seasons to survey refuge areas. Avoid surveying during hot weather when mollusks will be inactive, either hibernating or aestivating, and hidden to protect themselves from temperature extremes and desiccation most of the year. Disturbance during this time of year can result in the death of some specimens.

II.C.2. Time of Day

During the proper seasons to survey, time of day to search is generally not critical, providing that the surveyor has enough light for adequate visibility. However, understanding mollusk daily movement patterns helps to improve survey efforts. Many mollusk species are most easily seen early in the morning when conditions are cool and moist, before they move to their daytime retreats. Mollusks will be actively foraging, breeding (fall), and using more of the area during these moist periods. Some species are photophobic and will retreat when light levels are high, but stay out on cloudy or rainy days. Good visibility is important to the surveyor and suitable search time may be cut short as light levels drop in the late afternoon during the fall and winter months, especially in closed forest stands. Night surveys, aided by night-vision goggles, headlamps or flashlights, have been found to be effective in locating slug and snail species.

II.C.3. Number of Visits

Two surveys are required in order to ensure that a range of environmental conditions are present. Mollusk species are very sensitive to changes in moisture, temperature and light, and survey results can vary considerably from visit to visit. As described above, some slug and snail species have preferred seasons and/or weather conditions when they are most active and apparent to surveyors. Repeated visits, spaced several weeks apart, help to ensure that these conditions occur during a survey. Successive visits should be at intervals of three or more weeks. It is recommended that at least one survey should be done well within the autumn rainy season as discussed above under section II.C.1. The other survey may be done in either season while weather conditions are suitable.

Two visits also increase the extent of area covered and help to delineate the extent of known sites. Survey routes and sample areas delineated for the second visit should be in areas not covered by the first visit, although some overlap is acceptable. If known sites are established during the first visit, the second visit should be designed to cover only the remaining suitable habitat that is outside of any designated management areas around those sites. If an interdisciplinary team determines that one site potential tree distance around the population is appropriate to maintain habitat conditions in a particular project area, then the subsequent visit to that site need not cover the area within this distance. Likewise, if the management recommendation is to drop the entire project if a known site is located, the second visit is unnecessary.

II.C.4. Duration of Visits

A minimally adequate survey can be assumed when the following criteria are met:

1) Averaged for the survey area, **at least 60 minutes for every ten acres of survey area** has been spent actively searching . This time should be divided into **20 minutes each for two sample areas** (or less if all target species have been located at a given sample area) and **20 minutes total for point searches outside of sample areas**; or

2) In rocky areas, the size of the deposit affects the time that one will have to spend surveying for target species. **A minimum of 20 minutes** should be spent in searching any rocky area, cave, or talus deposit. At least **45 minutes** should be spent searching a deposit **one acre in size. For one to five acres, one and a half hours will be needed on site and at least two sample areas** should be established and searched. (For larger deposits, the general survey protocol times and procedures described above apply); and

3) The identified survey area has been well covered in the search, regardless of survey type that has been employed. Well covered means that sample areas and point searches were distributed through the survey area as detailed in Sections II.B.1 and II.B.2 as appropriate, so that a good representation of the habitat within the delineated survey area has been searched.

Hints for success:

- The more intensive a search, the more likely it will be to find the target species. Two or three surveyors will find more terrestrial mollusks than one would because of differing search images and abilities. Keep in mind, however, that multiple surveyors do not reduce the minimum search time requirements as described in the section on duration of visits, except that an individual sample area search may be completed sooner if all target species are located.

- More field time would be expected to be required for areas with relatively high gastropod populations, because chances of finding a target species are greater and many other species will be encountered, which will require more time to examine specimens and record data. **Search time as defined above does not include time spent walking, identifying specimens, or recording data.**

- Spacing visits apart by periods longer than three weeks may increase the chances of finding more specimens. Variations in mollusk behavior through the seasons will result in differing success at locating specimens.

Safety Considerations

These safety considerations are not meant to be an inclusive list of hazards expected to be encountered while doing this protocol survey method. They are simply some important ideas to keep in mind. If a potato rake or garden fork is used during surveys, the tines should be ground off to dull the points to prevent impaling snails and other small animals, and to avoid injury to the surveyors.

Appropriate sanitation should be observed while surveying for mollusks. Snails and slugs are intermediate hosts to many parasites of mammals and other animals, though these parasites that are native to the Pacific Northwest are not known to infect humans directly. Hands should be washed or disinfected after handling them.

Habitats of the Chelan mountainsnail and other species found in semiarid and rocky landscapes are also prime habitats for Rattlesnakes, black widow spiders, scorpions and other venomous species. Using the handle of a potato rake or other staff to probe vegetation is recommended. Heavy, high-topped boots should always be worn it areas where rattlesnakes can be expected.

Surveyors should remain alert for nests of wasps and hornets which may be broken into when searching through woody debris.

Since surveys are required during the fall season, field personnel may be working in heavy cover during hunting season. When bent over, searching the ground for mollusks, the risk of accidental shooting is greatly increased. Take precautions such as wearing brightly colored clothing, making noise, working in pairs and having radio contact with other field workers during this season.

APPENDIX E

Field Form and Instructions

This Appendix contains a suggested "Mollusk Survey Field Form" including definitions and directions for completing it. This form contains information for documenting locations of Survey and Manage species for the Known Site Database, and it provides a permanent record that the survey was done.

The first portion of one survey form will need to be completed for each survey area, even if no target species are found. Required information includes location, date and search time, surveyor name and survey area description. For each site at which a target species is found, an additional form is completed, including the lower portion concerning site information.

The bottom portion of the Mollusk Survey Field Form is a list of the C-3 species found and microsite information. Record all target species encountered on the field form and locations of all such sites. Recording the time at which each was first found helps to document times between encountering new species for a check for adequate surveys (see "Duration of Visits", above). If a species is not known, record it to the nearest known taxon (e.g., *Punctum* #1; or, Snail #2, etc.) and note the time it was first seen. Record the same taxon indicator along with the survey area name or number, and the date on the container in which specimens of these are collected, so that the specimen can be referred back to the field notes or form.

Habitat information is optional, but very valuable. Good records of habitat characteristics are especially important since so little is known about these C-3 species and their ecology. Plant community data and microsite feature associations are the key to future management on the landscape scale.

Data Management

Complete Mollusk Survey Field Forms in the field, as the surveys are done. Attach copies of the maps and/or aerial photographs, on which the survey areas, routes and sample areas are delineated, to the completed Mollusk Survey Field Forms. File these documents as appropriate.

When target species are found, be sure that the Mollusk Survey Field Form includes location information needed for the "Survey and Manage Known Site Database" (see Appendix A1 of the Mollusk Survey Protocol) and that site locations of target species are clearly indicated on copies of the maps and/or aerial photographs. Enter appropriate information into the Survey and Manage Known Site Database and maintain the documentation for future reference.

TERRESTRIAL MOLLUSK SURVEY FORM

REQUIRED AREA DATA

STATE_____ COUNTY_____ DATE_____

FEDERAL LAND UNIT_____ VISIT NO.____ SITE (NAME/NO.)_____

T. ___, R. ___, S. ___, QUARTERS _____ T. ___, R. ___, S. ___, QUARTERS _____

SEARCH TIME: FROM ____ TO____ – FROM ____ TO____ TOTAL ____

S & M SPECIES FOUND? YES_ NO_ UNCERTAIN (EXAMPLES COLLECTED)____.

SURVEYOR NAME:_____ _____

PRINT SIGNATURE

REQUIRED DISCOVERY SITE DATA (IF S&M SPECIES FOUND)

T.____ , R.____ , S.____ , ____ 1/4 OF ____ 1/4 OF ____ 1/4.

NAME OF SAMPLE POINT:_____

ACCESS DESRIPTION: _____

_____

_____

_____

_____

LAT. & LONG. OR UTM _____ _____

SPECIES_____ No. live____ No. shells____SPECIES_____ No. live____ No. shells____

SPECIES_____ No. live____ No. shells____

OPTIONAL DATA

PLANT ASSOCIATION_____

OVERSTORY SPECIES AND %:_____

UNDERSTORY SPECIES AND %:_____

GROUND COVER SPECIES AND %:_____

STAND AGE _____; SUCCESSION STAGE _____; CANOPY_____% ASPECT _____

SPECIAL HABITAT TYPE_____ MICROSITE FEATURE_____

ELEVATION_____; SLOPE_____%; SLOPE POSITION_____

TEMPERATURE: AIR____ C/F; GROUND____C/F; WEATHER _____

Comments (and disposition of any samples):_____

_____

_____

_____